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THE DESIGN PROFILE OF THE DIRECTIONAL WELL ON THE NORTHERN GOTURDEPE FIELD

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Abstract: When deciding to use the method of dual completion, the degree of depletion of reserves, the proximity of the oil-bearing contour to wells, the presence of resins and paraffin in the extracted oils, the thickness of productive layers and the non-permeable layers separating them, the state of the production column of wells, etc. are taken into account. The positive effect of applying the technology dual completion is expressed in a reduction in capital investments for the construction of wells for each of the operational facilities, in reducing operating costs and the development period of a multi-layer field, in increasing the production of hydrocarbons and the term of final oil recovery with cost-effective operation of wells. In addition, the use of this technology contributes to an increase in the utilization rate of downhole equipment and the reliability of the downhole installation. When two horizons are operated separately at the same time, the layers are separated from each other by a packer. One or two rows of pumping and compressor pipes descend into the well, which are lowered in parallel or concentrically. With dual completion of two or more horizons, reservoir development can be carried out according to the following schemes: fountain-fountain; fountain-pump; fountain-gas lift; fountain-injection; gas lift-pump; gas lift-gas lift, gas lift-injection; pump-pump; pump-injection; pump-injection. The article considers the experience of drilling a directional exploration well in Turkmenistan in order to trace and clarify the expansion of the area of productive horizons in the coastal zones of the coastal waters of the Caspian Sea. This work can be used for the development of fields in difficult-to-develop shallow waters and to reduce costs during their drilling, as well as to increase the volume of oil produced in order to develop the field using the method of dual completion (accelerated method), without increasing the oil recovery coefficient.

Key words. Displacement, vertical, along the hole, intensity, directional section, wellhead.

1. Introductions

The experience gained during the construction of a directional exploration well in southwestern Turkmenistan allowed us to conclude that it is possible to conduct exploration work on the site of this field, located in the shallow waters of the Gulf of the Caspian Sea, with the help of directional wells with a deviation of the bottom a long distance from the vertical.

2. Aim

Exploration well №204 on the Northern Goturdepe area was laid due to the lack of seismic exploration at the field to trace productive horizons and expand the area for drilling operations.

Drilling of directional wells on the artificial islands being created can significantly reduce the costs of exploration operations at the field [1,2,3]. Directional exploration well №204 was drilled with a face deviation of more than 1000 meters from the vertical. The well to a depth of 3000 m was drilled vertically.

3. Materials and methods

The project for the construction of exploration well №204 with a depth of 4250 m (vertical) 4662 m (along the hole) at the field in question was developed on the basis of a combined pressure graph in drilled wells and calculations of the hole trajectory. That is, the guide shaft with a diameter of Ø720 mm was lowered to a depth of 10 m and secured with rubble concrete. The elongated direction with a diameter of 530 mm was lowered to a depth of 30 m, the conductor Ø = 426 mm – by 600, the first technical column Ø= 324 mm to prevent hydraulic fracturing and collapse of the "black clay" – by 2800 m. The second technical column Ø = 244.5 mm to a depth of 4100 m vertically and along the hole 4450, to overlap the upper productive layers. The operational shank Ø = 139.7 mm, descended to a depth of 4250 m vertically and along the hole 4662 m with the installation of the liner suspension device 50-100 m higher inside the casing Ø = 244.5 mm in order to attach it to the well wall and isolate productive layers. The design design of the exploration directional well №204 on the Northern Goturdepe area is shown in Figure 1.

Drilling up to 3000 m was carried out vertically on an ALKAR-3M type drilling fluid with a density of 1.45 g/cm^3 and a 244.5 mm casing string was fixed in order to isolate two packs of black clays. The parameters of the drilling fluid were adhered to within the following limits: conditional viscosity 6-8 in 30 seconds, clay crust thickness 1-1.5 mm, static shear stress in 1-10 minutes 10-15, alkalinity pH 11-12, total mineralization 15-17.

Drilling fluid preparation was carried out with seawater. In order to maintain the design parameters of the drilling fluid, when drilling the cement cup of the conductor and the first technical column, 20 kg of soda ash was added to the drilling fluid for

drilling 1 m of cement stone. According to the norm, oil was added per 1m of 40 kg penetration to retain the lubricating properties of the drilling fluid.

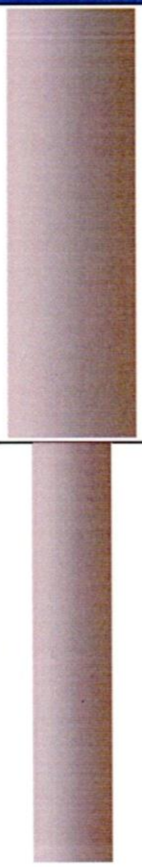
Diameter of the hole (mm)	Diameter of the column (mm)	Well design	Depth along the hole (m)	Solution system	The density of the solution g/sm^3	The cost of the solution
393.7	324		2800	Alkar-3M		
295.3	245		2800 - 3000	Alkar-3M		
295.3			3000 - 4450	HBR Versadril	1.45	
215.9			4450 - 4662	HBR Versadril	1.45	

Figure 1. Design of well № 204 on the Northern Goturdepe field

Before the descent of the conductor and casing columns into the well, the drilling fluid was treated with concentrated chemical reagents, and the borehole was worked out with rigid layouts of the bottom of the drill columns in order to unhindered descent and fastening of the casing columns to successfully achieve the design depth of the drilled well.

The design data of the profile of well №204 on the Northern Goturdepe area are shown in the table 1.

Table 1.

Name	Depth (m)	Zenith angle (deg)	Azimuth (deg)	Vertical depth (m)	Displacement (m)	North-South (m)	East-West (m)	Azimuth of displacement (deg)	Angle set interval (deg/30m)
Wellhead	0,00	0,0	270,0	0,0	0,0	0,0	0,0	0,0	0,0
Ø324 mm	2800	0,0	270,0	2800	0,0	0,0	0,0	0,0	0,0
Dial angle	3000	0,0	270,0	3000	0,0	0,0	0,0	0,0	0,0
Stabilization Interval	3385,71	45,0	270,0	3347,26	143,84	0,0	-143,84	270	3,50
Ø 244,5 mm	4450,24	45,0	270,0	4100	896,58	0,0	-896,58	270	0,0
Final depth	4662,37	45,0	270,0	4250	1046,58	0,0	-1046,58	270	0,0

A three-interval rectilinear profile was used to drill the well. Drilling of the well from a depth of 3000 m was carried out with the assignment of the zenith angle according to the azimuth of 270°. The design size of the zenith angle is -45°; the maximum intensity of the angle set is -3.5°/ 30m; the displacement of the bottom of the well is -1046.58 m. At a depth of 3000 m, before drilling of the inclined section, the water-based drilling fluid used was replaced with Versadril, which is a hydrocarbon-based drilling fluid. The Versadril system is one of the best systems for drilling clays, where the stability of the hole is the main criterion. In addition, this system operates at high temperatures up to 180-190°C and has more improved rheological properties. The “Versadril” system has a very low water output.

The actual drilling of the well with amendments was brought up to 4850 m (along the hole) [6, 8, 11, 12].

In the process of drilling this well, geological and technological studies were regularly carried out. They control drilling parameters, assess the overall situation, select collectors in cross section and determine their saturation state, as well as prevent accidents.

The station consists of three main modules:

− technological (real-time drilling monitoring);

− gas logging module (recording the total volume of gas content and analysis of the composition of gas impurities);

− geological module (operational analysis of core, sludge, drilling fluids and reservoir fluids) [4, 5, 7, 9, 10].

Figure 2 shows the design profile of the borehole № 204 Northern Goturdepe.

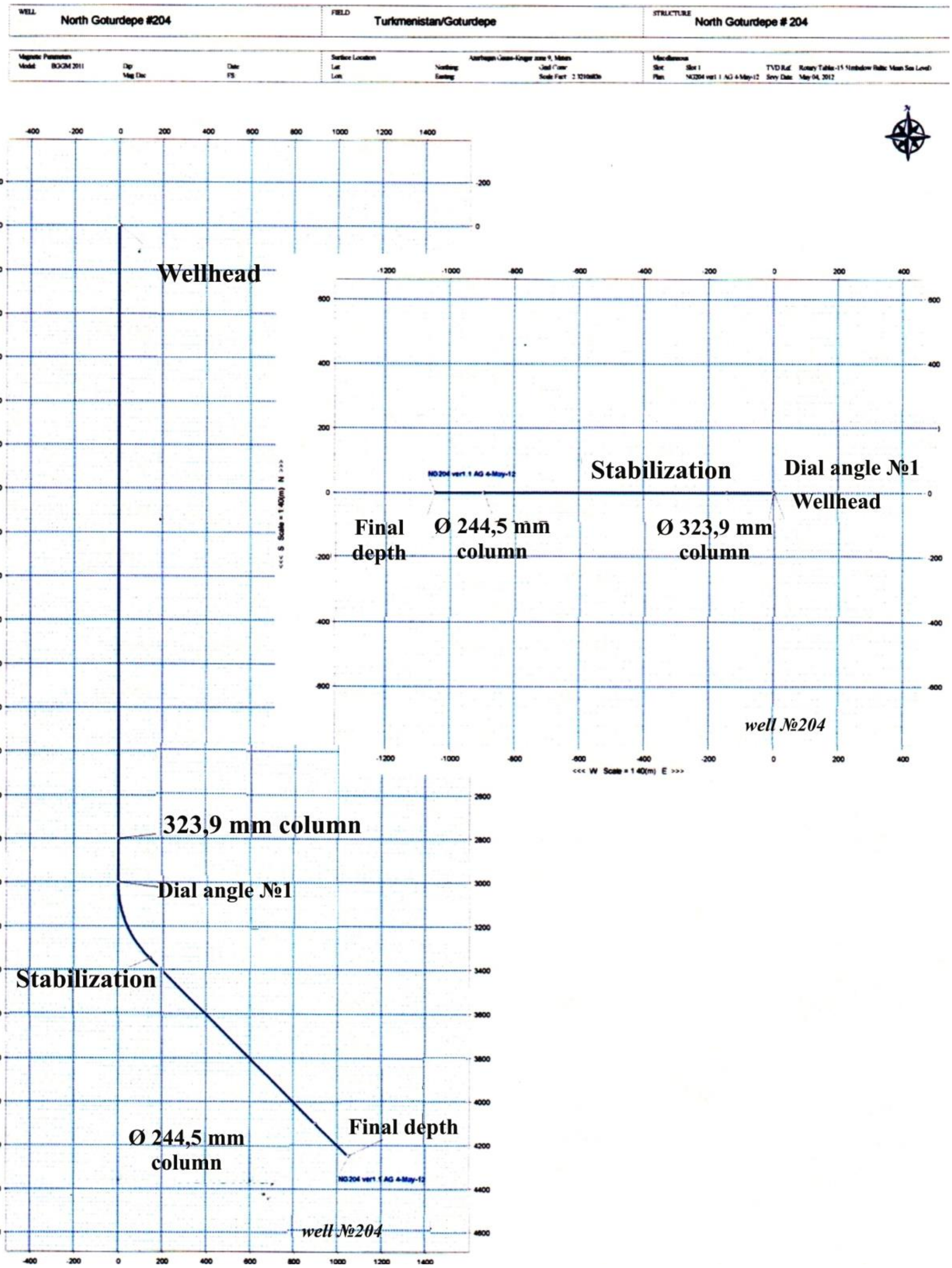


Figure 2. Design profile of the borehole № 204 Northern Goturdepe

4. Results and discussion.

After bringing the well to the design depth, it was decided to deepen the well to solve the tasks of searching for productive formations. The well was deepened to 4865 meters and an operational column with a diameter of 139.7 mm was lowered [13, 14, 15].

When drilling a well, the maximum displacement of the bottom was 1167.48 m with a magnetic azimuth of 266.15 °, the maximum zenith angle at a depth of 4440 m was 53.46°. As a result of the development of the first facility, an inflow with a maximum total flow rate of 80 tons /day was obtained.

5. Conclusions

Directional exploration well №204 on the Northern Goturdepe square has successfully fulfilled its goal, confirming the oil and gas potential of this section of the field without additional costs of materials and time for the construction of a bulk site. The first directional exploration well drilled in Turkmenistan with a significant offset from the bottom creates an opportunity to further accelerate exploration work at the field site in the Caspian Sea and hard-to-reach places.

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